U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE

HEARING CHARTER

The Role of the National Science Foundation in K-12 Science and Math Education

Wednesday, May 3, 2006
10:00 a.m. - Noon
2318 Rayburn House Office Building

1. Purpose

On Wednesday, May 3, 2006, the Committee on Science of the U.S. House of Representatives will hold a hearing to review the effectiveness and value of the National Science Foundation's (NSF's) past and present programs in support of improvement of K-12 science and math education and to examine what role the Foundation should play in future federal initiatives for strengthening K-12 science and math education.

This hearing follows up on the March 30 Science Committee hearing entitled, "K-12 Science and Math Education Across the Federal Agencies," which featured Secretary of Education Margaret Spellings, NSF Director Arden Bement, and representatives from the National Aeronautics and Space Administration, the National Oceanographic and Atmospheric Administration, and the Department of Energy. The officials outlined their individual agencies' activities to improve K-12 science and math education and described interagency coordination efforts. The charter for that hearing is attached (Appendix I).

The 2005 Presidential Awards for Excellence in Mathematics and Science Teaching will be announced the week of May 1, and a number of the awardees will be present at the Science Committee hearing. Immediately following the hearing, the Chairman will invite the awardees to participate in a question-and-answer session with Science Committee members to discuss the teachers' experience with K-12 science and math education and NSF.

2. Witnesses

Dr. Dennis Bartels is the executive director of The Exploratorium science museum in San Francisco. Before joining the Exploratorium in May 2006, he was the president of TERC, a Massachusetts-based not-for-profit education research and development organization dedicated to improving science, math, and technology teaching and learning.

Dr. Joseph Heppert is a professor and chair of chemistry and director of the Center for Science Education at the University of Kansas. He also chairs the American Chemical Society Committee on Education.

Ms. Rebecca Pringle is a physical science teacher at Susquehanna Township Middle School in Harrisburg, Pennsylvania. She serves on the Executive Board of the National Education Association.

Ms. Judy Snyder is a math teacher at Eastside High School in Taylors, South Carolina. She is a winner of a 2005 Presidential Award for Excellence in Mathematics and Science Teaching.

3. Overarching Questions

- What unique contributions does NSF make to K-12 science and math education programs? What types of programs should NSF sponsor to have the greatest impact on improving the capabilities of science and math teachers? To what extent are these types of programs currently being supported by NSF, and where is there room for improvement?
- Among existing mechanisms for improving K-12 science and math education, what is the correct level of priority to give to providing increased professional development opportunities to improve the subject matter knowledge of science and math teachers? What is the correct level of priority to give to improving pedagogical skills?
- What types of education programs is NSF best suited to sponsor? What are the relative roles of NSF and the Department of Education in improving K-12 science and math education, and what opportunities exist for collaboration between the two agencies?

4. Brief Overview

- The National Academy of Sciences' report *Rising Above the Gathering Storm*[1] pointed to the relatively poor performance of U.S. students in science and math as a threat to the nation's long-term economic health. The report's recommendations included attracting new science and math teachers through the use of scholarships and bolstering the skills of the existing science and math teaching corps through extensive professional development opportunities.
- Historically, NSF's mission has included supporting and strengthening science and math education programs at all levels. In the area of K-12, NSF carries out its mission by funding a variety of science and math education activities, including teacher training (both in-service and pre-service), curriculum development, education research, and informal education at museums and science centers.
- NSF also is the primary federal agency with programs focused on improving science and math education at the undergraduate level. At a Science Committee hearing earlier this year, Nobel Prize-winning physicist Carl Wieman emphasized that improving instruction in K-12 science and math education depends on improving the science and math training of the undergraduates who become K-12 teachers. NSF sponsors a number of programs to bolster the science and math skills of the nation's future teaching corps, including the Robert Noyce Scholarship Program, which provides scholarships to students majoring in science and math fields in exchange for them serving as teachers after graduation.

[1] *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, National Academies Press, Washington, D.C. (2006).

- In the past few years, funding for NSF education programs, including K-12 and undergraduate programs, has declined. Most NSF education programs are housed in the Education and Human Resources (EHR) Directorate, and the President's budget proposes $816 million for EHR in fiscal year 2007 (FY07), a level that only begins to restore cuts EHR experienced in previous years (dropping from $944 million in FY04 to $797 million in FY06).
- In his State of the Union Address in 2006, President Bush announced an American Competitiveness Initiative, which includes the creation and expansion of a number of programs specifically targeted at improving K-12 science and math education. The President's FY07 budget proposes $380 million in new funding for these programs, all based at the Department of Education.
- In February 2006, Congress created the Academic Competitiveness Council (ACC), a cabinet-level group tasked with coordinating and evaluating federal activities in science and math education. On March 30, 2006, the Science Committee held a hearing in which the Secretary of Education, the Director of the National Science Foundation, and representatives from the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, and the Department of Energy discussed their efforts to strengthen K-12 science and math education.

5. Background

K-12 Science and Math Education at the National Science Foundation

Science and math education is a cornerstone of the historic mission of the National Science Foundation. *The National Science Foundation Act of 1950*, which established NSF, directed NSF to support and strengthen science and math education programs at all levels. NSF carries out its K-12 mission by supporting a variety of science and math education activities, including teacher training (both in-service and pre-service), curriculum development, education research, and informal education at museums and science centers.

Examples of NSF programs designed to improve teacher performance, enhance understanding of student retention of scientific content, and develop and assess curricula include the Centers for Learning and Teaching, which provide professional development opportunities for K-12 teachers; the Advanced Learning Technologies program, which supports cognitive science research on the use of technology to enhance learning and teaching; and the Instructional Materials Development program, which supports the development of curriculum as well as research into the most effective means of teaching math and science material.

In addition to these programs, other NSF education programs focused on improving K-12 education include the Math and Science Partnership Program and the Robert Noyce Scholarship Program, both authorized as part of *The NSF Authorization Act of 2002* (Public Law 107-368). The Math and Science Partnership Program funds partnerships between universities and local school districts to strengthen the science and math content knowledge of K-12 schoolteachers. The grants are awarded to support the creation of innovative reform programs that could be expanded to the state level if successful. The Robert Noyce Scholarship Program is designed to help recruit highly-qualified science and math teachers through grants to college and universities

to give scholarships to science and math majors in return for their commitment to teach at the elementary or secondary school level.

Additionally, a number of programs exist at NSF to improve the content knowledge of undergraduate science and math majors, including those who may go on to become K-12 teachers. Examples include the Science, Technology, Engineering, and Mathematics Talent Expansion Program, which provides funding to colleges and universities to develop recruitment and retention strategies to increase the number of students majoring in science, mathematics, and engineering, and the Course, Curriculum and Laboratory Improvement Program, which supports efforts to create new learning materials and teaching strategies for science, mathematics, and engineering courses and conduct research on teaching and learning in those fields.

Most NSF education programs are housed in the Education and Human Resources (EHR) Directorate. The President's budget proposes $816 million for EHR in FY07, a level that only begins to restore cuts EHR experienced in previous years (dropping from $944 million in FY04 to $797 million in FY06). Funding for the K-12 programs within EHR experienced similar declines in that period, with "formal" K-12 programs[2] going from $118 million in FY04 to $93 million in FY06 and the NSF's Math and Science Partnership Program (NSF MSP) dropping from $139 million in FY04 to $63 million in FY06.

Presidential Awards for Excellence in Mathematics and Science Teaching

As part of its mission to support outstanding classroom science and math instruction, NSF administers the Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST). Up to two K-12 science or math teachers from each of the U.S. states and territories are recognized each year for their contributions in the classroom and to the teaching profession. The Foundation provides each PAEMST recipient with a $10,000 award and professional development opportunities while recognizing them as leaders in education and inspiration to their colleagues. The award was established by Congress in 1983.

The 2005 awardees, all 7th through 12th grade science or math teachers,[3] have been invited to attend this hearing and to speak at a post-hearing open session about their experiences in science and math education and with NSF in particular. Ms. Judy Snyder, who is testifying at the hearing, is the 2005 awardee in math teaching from South Carolina. The full list of PAEMST awardees will be available at http://www.paemst.org.

[2] The "formal K-12 programs" are the Instructional Materials Development Program, the Teacher Professional Continuum Program, and the Centers for Learning and Teaching Program, which were combined to form the Discovery Research K-12 program in the recent reorganization of NSF EHR.
[3] In even-numbered years, the award is given to elementary teachers (grades K-6); in odd-numbered years, secondary teachers (grades 7-12) are recognized.

6. Questions for Witnesses

The witnesses were each asked to address the following questions in their testimony before the Committee:

- To what extent could your programs have been created or operated without NSF? In what ways did NSF programs contribute to the way you decided to shape your programs? To what extent has NSF affected the way you are evaluating your programs? To what extent did NSF's competitive, peer reviewed proposal process affect the way you designed and executed your programs?
- Among existing mechanisms for improving K-12 science and math education, what level of priority would you give to providing increased professional development opportunities to improve the subject matter knowledge of science and math teachers? What level of priority would you give to improving pedagogical skills? What types of programs should NSF sponsor to have the greatest impact on improving the capabilities of science and math teachers? To what extent are these types of programs currently being supported by NSF? What suggestions do you have for improving NSF education programs?
- What types of education programs is NSF best suited to sponsor? What do you see as the relative roles of NSF and the Department of Education in improving K-12 science and math education, and what opportunities exist for collaboration between the two agencies?

APPENDIX I

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE

HEARING CHARTER

K-12 Science and Math Education Across the Federal Agencies

Thursday, March 30, 2006
10:00 a.m. - Noon
2318 Rayburn House Office Building

1. Purpose

On Thursday, March 30, 2006, the Committee on Science of the U.S. House of Representatives will hold a hearing to examine how federal agencies can improve their individual and collective efforts to strengthen K-12 science and math education.

2. Witnesses

Ms. Margaret Spellings is the Secretary of the U.S. Department of Education (ED).

Dr. Arden L. Bement is the Director of the National Science Foundation (NSF).

Ms. Shana Dale is the Deputy Administrator of the National Aeronautics and Space Administration (NASA).

Brigadier General John J. Kelly (ret.) is the Deputy Undersecretary for Oceans and Atmosphere of the National Oceanic and Atmospheric Administration (NOAA).

Dr. James Decker is the Principal Deputy Director of the Office of Science at the U.S. Department of Energy (DOE).

3. Overarching Questions

- To what extent and how are the federal agencies involved in K-12 math and science education coordinating their efforts? What are their individual roles? To what extent and how do they ensure that their individual programs are complementary?
- Are there uniform evaluation tools that agencies do or could use to determine the effectiveness of their programs?
- How do individual federal agencies strike a balance in their portfolios among K-12 math and science programs that are designed to encourage students who show great promise and interest, programs that are designed to help students who are struggling academically, and programs that are designed to attract girls, underrepresented minorities or students from low-income families? Should every federal agency administer programs for each

subgroup of students or are some agencies better served by targeting specific populations, such as those who are academically promising and/or underrepresented?

4. Background

Brief Overview

The quality of K-12 math and science education has been a growing national concern. Most recently, the National Academy of Sciences' report *Rising Above the Gathering Storm* pointed to the relatively poor performance of U.S. students in math and science as a threat to the nation's long-term economic health. Numerous reports in recent years, including the Academy report, have called for renewed efforts to improve K-12 education, particularly by attracting top students into teaching and improving the training of both current and future teachers to deepen their understanding of, and comfort with, math and science content. Prompted by such recommendations, the Science Committee has pushed for years to enhance federal K-12 math and science education efforts, particularly at NSF.

NSF and ED are the two primary federal agencies with responsibility to improve K-12 math and science education. Other federal agencies have also run a variety of programs to improve and promote math and science education, often because they have scientists and research facilities that can be tapped for such activities. Those agencies, including DOE and the NOAA, also feel a commitment to keeping science strong in the U.S. since performing research is part of their missions. In addition, Congress has earmarked funds for education programs and grants in some of the agencies, particularly NOAA and NASA.

The range of education programs across the agencies can be seen as a strength – allowing program diversity and ensuring that all available federal science resources are contributing to K-12 education. But that diversity has also provoked concerns periodically that the federal efforts are uncoordinated and include many programs that are too small to make a difference or are otherwise ineffective and that the education programs are a distraction from agencies' primary missions. A report released by the Government Accountability Office (GAO) in October 2005 found that at least 13 agencies conduct programs designed to strengthen math and science education and raised questions about the lack of evaluation of a number of the programs. In February 2006, Congress created the Academic Competitiveness Council (ACC), a cabinet-level group tasked with coordinating and evaluating the federal role in math and science education.

Coordination could provoke a different set of concerns if it leads to all federal programs fitting a single mold, dominated by *No Child Left Behind*, which some critics charge has led to a reduced focus on science education in the schools. For example, a survey released this week by the Center on Education Policy found that most schools are increasing their focus on reading and math by reducing instruction in other areas, including science. However, others point out that proficiency in math is needed to progress in science so that the emphasis on math skills hardly detracts from the effort to improve science achievement. Moreover, testing in science under the *No Child Left Behind Act* will begin in 2007, and the preparation for these assessments should place a renewed emphasis on science, as seen in the design of new science tests and the reform of science courses to align them to state standards.

GAO Report

In October 2005, the Government Accountability Office (GAO), at the request of Rules Committee Chairman David Dreier, attempted to inventory the federal programs that were designed to increase the number of students or graduates in science, technology, engineering and mathematics (STEM) fields or to improve the quality of education in those areas. The GAO report examined education programs at all levels, from kindergarten to graduate school, not just the K-12 fields that are the focus of this hearing. Among other things, GAO found the following:

- In fiscal year 2004 (FY04), 13 agencies[4] spent a total of $2.8 billion for 207 programs that were designed to increase the number of students and graduates or to improve educational programs in STEM fields.
- Of the 207 programs, 103 had not been evaluated, including 17 programs that had been operating for more than 15 years.
- 94 of the programs identified were funded at less than $1 million and 51 were funded between $1 and $5 million.
- Six federal agencies spent the bulk (about $2.6 billion) of the reported funding for STEM education. The largest amount of funding was at the National Institutes of Health, followed by NSF, NASA, ED, the Environmental Protection Agency, and the Health Resources and Services Administration (within the Department of Health and Human Services). The remaining agencies spent a combined total of $154 million.

According to GAO, the report took one year to complete due, in large part, to the amount of time agencies took to provide GAO with comprehensive information on their education programs. Also, since GAO relied primarily on self-reporting by agencies, the inventory is not a definitive list of STEM education programs or activities. (For example, the Science Committee is aware of programs that were not included in the survey, including several programs at NASA and the Department of Defense.)

Academic Competitiveness Council

Partly in response to the GAO report, Congress established the Academic Competitiveness Council (ACC), a cabinet-level group tasked with coordinating and evaluating the federal role in math and science education. Established in the *Budget Deficit Reduction Act* (Public Law 109-171), the ACC is chaired by the Secretary of Education and includes "officials from Federal agencies with responsibilities for managing existing Federal programs that promote mathematics and science." ACC is responsible, within a year, for (1) identifying all federal programs with a mathematics or science focus; (2) identifying the target populations being served by such

[4] The 13 federal agencies are as follows – National Science Foundation, Department of Energy, National Aeronautics and Space Administration, Department of Commerce, Department of Education, Environmental Protection Agency, National Institutes of Health, Department of Agriculture, Department of the Interior, Department of Homeland Security, Department of Transportation, Indian Health Service, and Health Resources and Services Administration. The Department of Defense, while identified by GAO as having STEM programs, did not participate.

programs; (3) determining the effectiveness of such programs; (4) identifying areas of overlap or duplication in such programs; and (5) recommending ways to efficiently integrate and coordinate such programs.

The ACC met for the first time on March 6, 2006, about a month after the Act creating it was signed into law. The ACC, in conjunction with the Office of Management and Budget, will inventory existing federal math and science education programs, sort these programs by program focus or goals, and then evaluate the effectiveness of the programs. Within one year, the ACC is required to submit to each Congressional committee with jurisdiction over a federal program identified as promoting math and science education a report detailing the ACC findings and recommendations, including recommendations for legislative or administrative action. The *Budget Deficit Reduction Act* provided ED with $50,000 to support the ACC's activities.

Prior to the creation of the ACC, there was already an existing mechanism for coordinating math and science education, established by Executive Order. The National Science and Technology Council (NSTC) is a cabinet-level council, overseen by the White House Office of Science and Technology Policy (OSTP), which serves as the principal means to coordinate the federal research and development enterprise. NSTC established a subcommittee on education in 2003, but it has been relatively dormant.

American Competitiveness Initiative

In addition to proposing the doubling of the combined budgets of the NSF, the National Institute of Standards and Technology, and DOE's Office of Science over the next 10 years, President Bush's *American Competitiveness Initiative* (ACI), proposes the creation and expansion of a number of programs specifically targeted at improving K-12 math and science education. To implement ACI, the President's budget request proposes $380 million for programs at ED, including:

- expansion of the Advanced Placement/International Baccalaureate (AP/IB) program to support an additional 70,000 AP/IB math and science teachers;
- creation of an Adjunct Teachers Corps to encourage up to 30,000 math and science professionals to become adjunct high school teachers;
- creation of "Math Now for Elementary Students" to help elementary school teachers learn proven methods and practices of math instruction; and,
- creation of "Math Now for Secondary Students" to promote research-based instruction to improve upper level math proficiency.

ACI also provides for the evaluation of federal science, technology, engineering and math programs, and proposes an additional $5 million to support the ACC's evaluation efforts.

Key Federal Agencies

NSF and ED are the two agencies of the federal government that share primary responsibility for programs in K-12 education. While ED is responsible for K-12 education across all disciplines and is experienced in addressing the systemic problems of education, including such varied challenges as student diversity (i.e. English language learners, students from low socioeconomic

backgrounds and students with special needs) and school financing, NSF is specifically concerned with improving math and science education. Another key difference between the two agencies is that ED funding is generally distributed by statutory formulas (usually based on student population and income), while NSF funding is competed for nationally and projects are chosen by peer review.

U.S. Department of Education

ED currently administers a budget of about $88.9 billion per year (that covers more than K-12 programs)—$57.6 billion in discretionary appropriations and $31.3 billion in mandatory spending—and operates programs that touch on every area and level of education. ED's current programs strongly emphasize equitable educational opportunity for all, and most major K-12 spending programs are designed either to equalize available funding among schools or school districts or to help specific groups of students, such as English language learners or those with special needs. In addition, while some ED programs, such as Reading First, are subject-specific, the vast majority of ED's programs allow states and school districts flexibility in choosing what sorts of programs or disciplines federal funding will be used to support.

The Math and Science Partnership at ED (ED MSP) is the one program that specifically seeks to increase the academic achievement of students in mathematics and science by enhancing the content knowledge and teaching skills of classroom teachers. Allowable uses of funding include professional development opportunities, recruitment bonuses and performance incentives for qualified math and science teachers, and scholarships for advanced coursework in math and science. Funding for ED MSP ($182 million in FY06), is, like most ED programs, distributed from the federal government to all 50 states by a statutory formula, based on state factors such as population and poverty. The amount of funds awarded to the states in FY05 ranged from approximately $888,000 for small states like Delaware to $24 million for large states like California. Each state then distributes the funding, on a competitive basis, to partnerships of school districts, schools, and an institution of higher education. According to Congressional Research Service analysis of ED awards, funding at the local level can range from $20,000 to $3.3 million, but it is not clear if this amount is for a single year or for a multiyear award.

National Science Foundation

The *National Science Foundation Act of 1950*, which established NSF, directs NSF to support and strengthen math and science education programs at all levels. Other statutes, notably the *Education for Economic Security Act* (Public Law 98-377, signed in 1984), have expanded this authority. Most recently, the Science Committee created additional education programs at NSF in the *National Science Foundation Authorization Act of 2002* (Public Law 107-368).

NSF carries out its K-12 mission by supporting a variety of math and science education activities, including teacher training (both in-service and pre-service), curriculum development, education research, and informal education at museums and science centers. A recent reorganization of K-12 education has divided NSF's activities into three categories: the development of more effective tests in math and science, improving science teaching and learning, and translating the results of education and cognitive research into classroom practice.

Like all NSF programs, funds for education projects are awarded through a national, competitive process that draws on a wide variety of experts from outside government for peer review of proposed activities. While most federal agencies make little effort to evaluate the effectiveness of their math and science education programs, NSF requires an evaluation component to be included in individual education projects, and also has commissioned evaluations of NSF's overall NSF education programs. NSF has sought outside advice on how to perform the evaluations. For example, a National Academy of Sciences committee in 2004 provided recommendations to further improve program and project evaluations at NSF.

Most NSF education programs are housed in the Education and Human Resources (EHR) Directorate. The President's budget proposes $816 million for EHR in FY07, a level that only begins to restore cuts EHR experienced in previous years (dropping from $944 million in FY04 to $797 million in FY06). Funding for the K-12 programs within EHR experienced similar declines in that period, with "formal" K-12 programs[5] going from $118 million in FY04 to $93 million in FY06 and the NSF's Math and Science Partnership Program (NSF MSP) dropping from $139 million in FY04 to $63 million in FY06.

President Bush proposed the creation of the NSF MSP as part of his original *No Child Left Behind* initiative, and NSF MSP was authorized as part of the *NSF Authorization Act of 2002*. Congress then created a complementary (and similarly titled) program at ED as part of the *No Child Left Behind Act*. The NSF MSP program funds partnerships between universities and local school districts to strengthen the content knowledge of elementary and secondary schoolteachers. The grantees are expected to run innovative reform programs that, if successful, would be the key to large-scale reform at the state level. Unlike ED MSP, NSF MSP funds are competitively awarded at the national level, and the grants range from $2.5 million per year for up to five years for targeted programs to $7 million per year for comprehensive efforts to improve math and science teaching and learning across the K-12 continuum.

In addition to NSF MSP and the "formal" K-12 programs, NSF also runs the Robert Noyce Scholarship Program, created by the *NSF Authorization Act of 2002*. The Noyce program awards grants to colleges and universities to award scholarships to top math and science majors or minors in return for a commitment to teach at the elementary or secondary school level two years for each year of support received. Universities may also use the grant funds to support programs to help these prospective teachers obtain their certification and prosper in their new profession. In FY06, the program was funded at $9 million, and $10 million is requested for FY07.

Outside of EHR, NSF supports education through its "broader impacts" criteria for all research grants awarded through its Research and Related Activities account. Applications for NSF research awards are reviewed not only to determine the merit of the proposed research activity, but also to determine how the activity will promote teaching, training and learning, broaden the participation of underrepresented groups, and provide larger benefits to society.

[5] The "formal K-12 programs" are the Instructional Materials Development Program, the Teacher Professional Continuum Program, and the Centers for Learning and Teaching Program, which were combined to form the Discovery Research K-12 program in the recent reorganization of NSF EHR.

Other Federal Agencies

U.S. Department of Energy

DOE runs its K-12 programs out of both headquarters and its National Laboratories, focusing primarily on supporting of mathematics, science and engineering education programs by using the personnel, facilities, equipment and resources of its laboratories to assist local schools, teachers and students. DOE's activities include providing research experiences for students intending to become math or science teachers, providing training for teachers who agree to become "teacher leaders" in math and science, and supporting academic competitions in science and math for high school students. The impetus for these programs often comes from individual National Labs, whose commitment to education often depends on the leadership at the lab. According to DOE, $86 million was spent on education activities at all levels in FY05, with $8 million specifically allocated for K-12 education.[6]

DOE's involvement in education, particularly at the graduate level, go back to its predecessor agency, the Atomic Energy Commission. Congressional support for DOE's educational programs has varied over time, with Congress sometimes encouraging these programs and sometimes discouraging them. In FY95, Congress appropriated $70 million to the DOE Office of Science Education and Technical Information for science education activities, including undergraduate research activities at DOE laboratories, graduate and faculty fellowships, teacher development programs and K-12 outreach. In FY96, Congress abolished the Office of Science Education and Technical Information, reduced funding for science education, and centralized the remaining education programs within the Office of Energy Research (now the Office of Science). In FY97, Congress eliminated all funding for university and science education programs at DOE but, in FY97 and FY98, required that line programs should sponsor the education programs. Most recently, the *Energy Policy Act of 2005* included a set-aside of 0.3 percent of the applied energy program research and development funding to support DOE Office of Science education programs, and several new programs were created at the undergraduate and graduate levels, again affirming the role of the agency in education.

National Aeronautics and Space Administration

NASA's organic act, the *National Aeronautics and Space Act of 1958*, directs the agency to expand human knowledge about space. As part of this effort, NASA's K-12 education activities include workshops and internships for teachers and students offered by NASA's centers, professional development for science and math teachers, and providing materials and visiting astronauts to schools, museums and science centers. Specifically, NASA K-12 education programs include the Educator Astronaut Program, which selects three teachers to become members of the Astronaut Corps, and the NASA Explorer Schools program, which brings together teachers and administrators to improve STEM teaching and learning in low-income schools.

[6] Additional funding from DOE's undergraduate activities, funded at $40 million in FY05, may have supported teacher training in math and science but a breakdown of this funding was not available at the time of the charter.

In recent years, NASA education has been organized in a number of different ways, from being consolidated into an "Enterprise" on par with other NASA activities, such as space flight, to being spread out throughout the agency. Today, NASA education is centralized in the Office of Education, which contains five program areas,[7] including one for Elementary and Secondary Education. Funding for Elementary and Secondary Education at NASA totaled $29 million in FY06. (Many NASA earmarks are focused on education activities; according to NASA, in FY06, 72 earmarks, totaling $82 million, were located within the $162 million budget of the Office of Education.) The *National Aeronautics and Space Administration Authorization Act of 2005* (Public Law 109-155) requires NASA to have the National Academy of Sciences conduct a review and evaluation of NASA's precollege science, technology, and mathematics education programs.

In addition to the activities funded through the Office of Education, NASA promotes education and outreach as an integral component of every major research and development mission, spending an additional $150 million on activities at all educational levels through its Mission Directorates. For instance, as part of the Materials International Space Station Experiment, NASA researchers worked with high school students to analyze the effects of low orbit on a variety of materials.

National Oceanic and Atmospheric Administration

NOAA's K-12 activities focus on improving understanding of earth and ocean sciences through such activities as teacher training and the development of educational materials.

NOAA's Office of Education serves as the primary point of contact for NOAA on education activities and coordinates the programs within the agency whose primary purpose is education. The FY06 budget for the Office was about $38 million, but there is no breakdown available for K-12 education. Historically, many of NOAA's education programs at the K-12 level have been funded through Congressional earmarks. The Administration believes that earmarks accounted for about half of the FY06 budget for the Office.

Earmarked programs include the creation of a high school earth system science laboratory course ($4 million in FY06), and several regional education and training programs to support hands-on environmental experiences ($7 million in FY06). Congress has also added funding to programs that promote the sciences through scientific expeditions, like JASON, which uses live broadcasts to share the discoveries of research at sea with students and teachers. Past JASON expeditions have "taken" students on such missions as an exploration of the Titanic and the discovery of zooplankton in Monterey Bay.

In addition to formal K-12 education activities, NOAA conducts informal education through its support of marine sanctuaries and reserves, funds lesson plans and teacher professional development in ocean sciences, and supports a "Teacher at Sea" program, which allows elementary teachers to go aboard NOAA research and survey ships to deepen their understanding of the ocean.

[7] The other program areas include Higher Education, e-Education, Informal Education and Minority University Research and Education.

Legislation

While this hearing is not designed to focus on any specific legislation, several bills have been introduced to strengthen STEM education in response to the various reports and commissions on U.S. competitiveness. Most of these bills seek to improve K-12 math and science education through teacher recruitment or training programs. For instance, S. 2198, Protecting America's Competitive Edge (PACE) Act, and H.R. 4434, introduced by Congressman Bart Gordon, authorize NSF to award scholarships to students majoring in STEM education who concurrently pursue their teacher certification, per the recommendations of the National Academy of Sciences' *Rising Above the Gathering Storm* report. S. 2197, PACE-Energy, also establishes a scholarship program for students in STEM fields and supports the creation of a part-time, three-year master's degree in math and science for teachers at DOE, not NSF. In addition, S. 2197 creates other new K-12 programs at DOE, including incentives to help states create math and science "specialty schools" and new training and research opportunities for K-12 teachers and students at the National Laboratories.

In addition to the competitiveness bills, other relevant introduced legislation includes H.R. 50, the NOAA Organic Act, which establishes as a NOAA mission educating the public about the Earth's oceans and atmosphere and fostering the public's ability to understand and integrate scientific information into considerations of national environmental issues. The Science Committee passed H.R. 50 last session.

5. Questions for Witnesses

The panelists were each asked to address the following questions in their testimony before the Committee:

- What are the one or two most important steps the federal government should be taking to improve K-12 science and math education and what is the role of your agency in taking those steps? What is the single most effective program your agency runs to help take those steps? How do you know that that program has been effective?
- In general, how does your agency evaluate its programs? Have you examined the evaluation techniques of other federal agencies and departments and, if so, do they have techniques that you have made use of or plan to make use of?
- How have you ensured that your agency's activities in K-12 math and science complement those of other federal agencies and departments in the following areas:
    1) attracting students to the teaching profession;
    2) providing pre- and in-service teacher training;
    3) developing curricula; and
    4) supporting informal learning.
- How do you decide how to strike a balance in your portfolio among K-12 math and science programs that are designed to encourage students who show great promise and interest, programs that are designed to help students who are struggling academically, and programs that are designed to attract girls, underrepresented minorities or students from low-income families (whatever their level of proficiency)? Should every federal agency

administer programs for each subgroup of students or are some agencies better served by targeting specific populations, such as those who are academically promising and/or underrepresented?